

Application No: 10/536,682
Amendment A
Reply to Office action of 10/05/2006

Attorney Docket No: 3926.176

REMARKS

Claims 16-25 are pending in the application. Claims 1-15 have been previously cancelled. Claims 16-18 have been amended.

Present Invention

One drawback of using iron or nickel or an alloy thereof as additional material for forming a valve seat is that iron and nickel have a significantly higher melting point than the cylinder head, which consists of aluminum. This can lead to the formation of intermetallic phases in the interfacial region, which can lead to very brittle microstructure. Consequently, it is difficult to achieve a homogeneous join between the valve seat and the base material of the cylinder head.

Copper as material for valve seats has the drawback, in particular in the case of diesel internal combustion engines, that the sulfur contained in the diesel fuel attacks the copper, which causes problems with regard to the exhaust gases produced and corrosion.

A wide range of proposals of other materials have been made. Hitherto, however, no solution has been so convincing that it has been able to replace the process of pressing the valve seat rings into place, which has long been used in practice.

Therefore, it is an object of the present invention to provide a valve seat for a cylinder head of an internal combustion engine and a process for producing it which has both good bonding to the base material of the cylinder head and good strength and wear properties.

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To achieve the above object, the present invention provides a valve seat for a cylinder head of an internal combustion engine, which includes an additional material fused to the base material of the cylinder head, which additional material includes at least an inner layer (6) facing the cylinder head (1) and an adjacent outer layer (7) more remote from the cylinder head (1), the inner layer (6) including copper or a copper alloy and having good joining properties with respect to the base material of the cylinder head (1), and the outer layer (7) including an alloy comprising nickel, iron and/or cobalt as its main constituent.

The present invention further provides a process for producing a valve seat for a cylinder head of an internal combustion engine which includes an additional material fused to the base material of the cylinder head, which additional material includes at least an inner layer (6) facing the cylinder head (1) and an adjacent outer layer (7) more remote from the cylinder head (1), the inner layer (6) including copper or a copper alloy and having good joining properties with respect to the base material of the cylinder head (1), and the outer layer (7) including an alloy comprising nickel, iron and/or cobalt as its main constituent, the process comprising

fusing the inner layer to the cylinder head at the location at which the valve seat is to be formed by the introduction of energy,

after the inner layer has been fused to the base material of the cylinder head, fusing the outer layer to the inner layer by the introduction of energy,

wherein the inner layer (6) is placed onto the cylinder head (1) in the form of a solid ring, and wherein the outer layer (7) is applied to the inner layer (6) in powder form.

Claim Rejections - 35 U.S.C. § 102

Claims 16-23 and 25 are rejected under 35 USC 102(b) as being anticipated by Adachi et al. (US 6,138,351).

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The Examiner has stated that Adachi et al. disclose a valve seat with an inner layer 45 and an outer layer 43. The inner layer includes a copper alloy and has good joining properties with respect to the base material of the cylinder head. The outer layer includes nickel, iron, carbon, chromium, molybdenum, cobalt, and tungsten.

However, it is noted that the layer 45 in Adachi et al. is formed from a portion of the material of the cylinder head 32 which has been plastically deformed (see column 4, line 66 – column 5, line 2) and thus is not additional material in the sense of the present invention. Also, the layer 45 is part of the material of the cylinder head 32, it does not contain copper or copper alloy. The copper mentioned in Adachi is a component of the material of the insert ring 43, which also contains carbon, nickel, chromium, molybdenum, cobalt, and tungsten (see, for example, column 7, line 65 – column 8, line 5).

Therefore, Adachi et al. do not disclose that the additional layer has an inner layer facing the cylinder head and including a copper or copper alloy.

Concerning claim 16, Applicants believe that the following important features of the present invention are not disclosed by Adachi et al.:

- In Adachi et al., an inner layer 45 is formed by plastically deforming material of the cylinder head. In contrast, in the valve seat of claim 16 of the instant application, the inner layer is formed of **additional material fused** to the base material of the cylinder head.
- In Adachi et al., the inner layer consists of the same material as the cylinder head. In contrast, in the valve seat of claim 16 of the instant application, the inner layer consists of copper or copper alloy whereas the cylinder head consists of an aluminum alloy.

Concerning claim 23, please note the following additional differences between the present invention and Adachi et al.:

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- In Adachi et al., the **outer layer 45** is a **solid ring** which is fused to the cylinder head, whereas in the process of claim 23, the **inner layer 6** is a **solid ring** which is fused to the base material of the cylinder head.

- In claim 23, the outer layer 7 is formed by applying a powder to the inner layer 6. Such a step is not disclosed in Adachi et al.

Claims 16-23 and 25 are, therefore, believed to be patentable over Adachi et al.

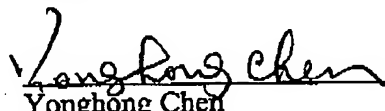
Claim Rejections - 35 U.S.C. § 103

Claim 24 is rejected under 35 U.S.C. 103(a) as being obvious over Adachi et al.

Claim 24 is believed to be patentable due to its dependency on claim 23.

Favorable consideration and early issuance of the Notice of Allowance are respectfully requested. Should further issues remain prior to allowance, the Examiner is respectfully requested to contact the undersigned at the indicated telephone number.

Respectfully submitted,



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